NGNGV Phase I: Clean Air Partners DF C12 w/EGR

Background/Objectives

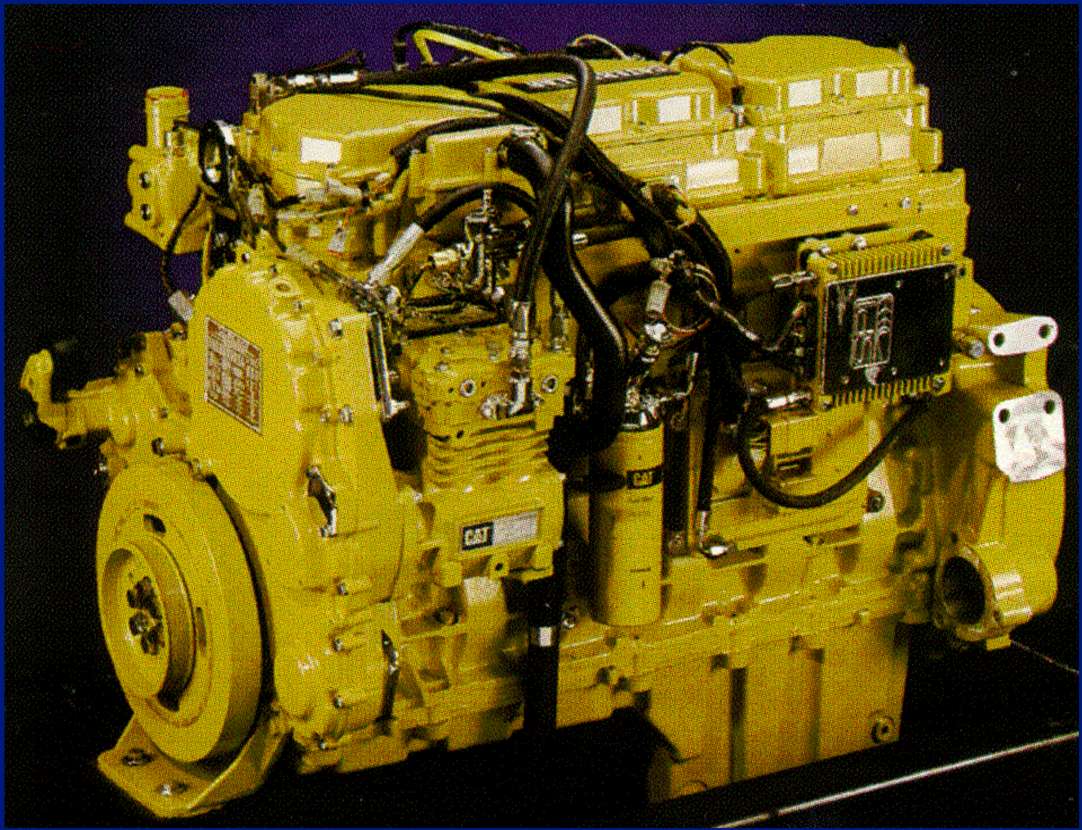
- Lab Development & Demo
- <1.0 g/bhp*h NOx (ERM #1)
- 0.2 g/bhp*h NOx (ERM #2)
- 0.01 g/bhp*h PM
- 400 h.p. / 1250 ft*lb

Funding

- $290k

Deliverables

- Modal Emissions & bsfc
- Subcontractor Report



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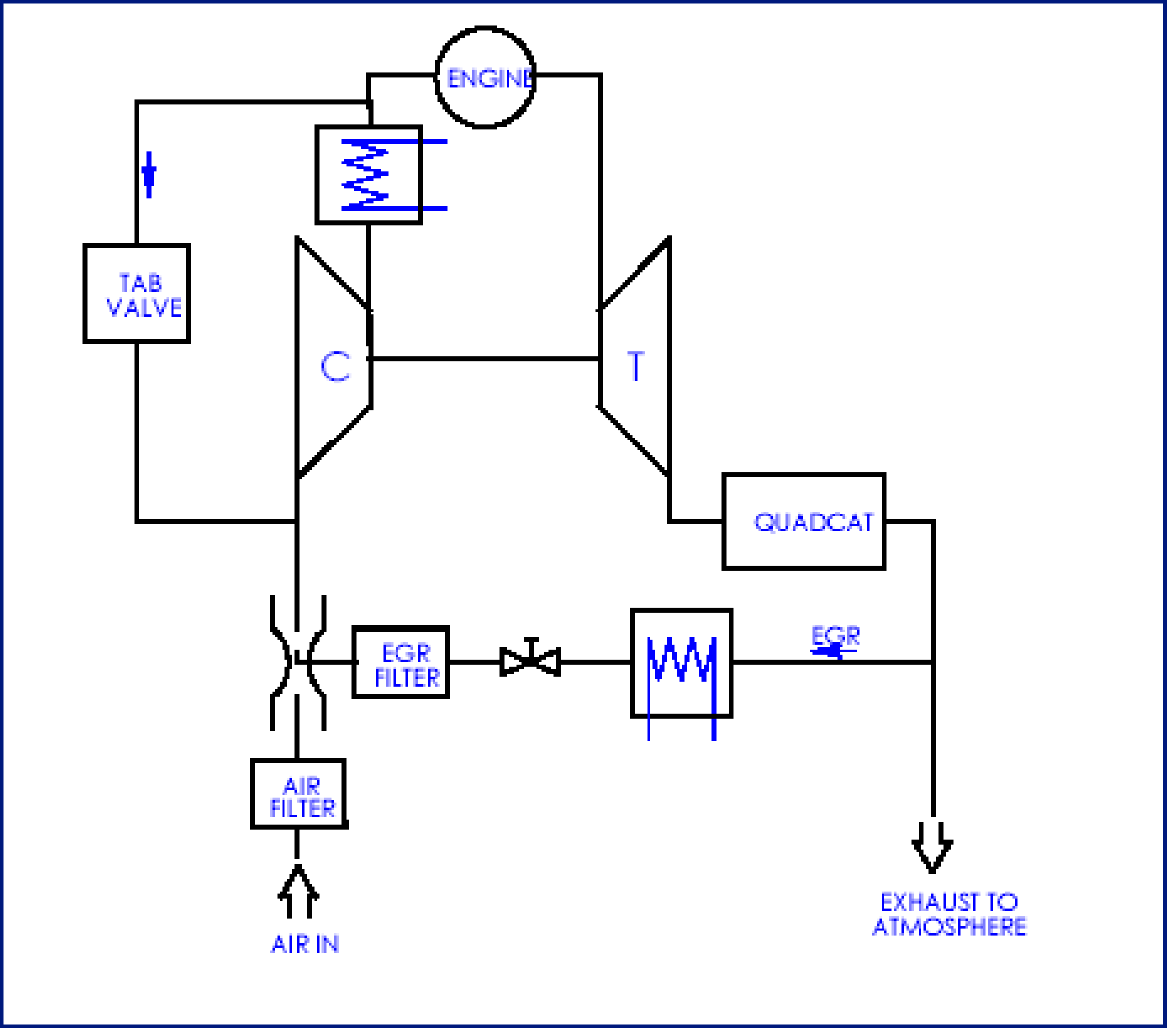
Emission Reduction Module #1- Passive AT

- Catalyzed DPF
- Cooled EGR
- Optimization Strategies
  - Timing
  - EGR Rate
  - Lambda
  - ➢ bsNOx
  - ➢ bsCO
  - ➢ bsHC
  - ➢ bsPM
  - ➢ bsEC



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ERM #1 (PACCOLD) Results:

	PACCOLD	Baseline	Change (%)
HC	17.7	12.38	43
NMHC	1.44		
NOx	0.54	2.38	-77.3
CO	0.05	4.05	-98.8
PM	0.0037		
Btu	7,610	7,124	6.8

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In addition, the following conclusions about the PACCOLD-EGR system were reached:

- A reduction in NOx of about 4% for 1% of EGR mass fraction is suggested as a working guideline.
- EGR mass fraction and pilot injection timing are the dominant parameters affecting NOx emissions.
- Unfavorable HC tradeoff for NOx is evident with retarded pilot injection timing.
- A total hydrocarbons catalyst will be required to further reduce NMHC and methane emissions.

Full report available at

http://www.nrel.gov/docs/fy03osti/33957.pdf

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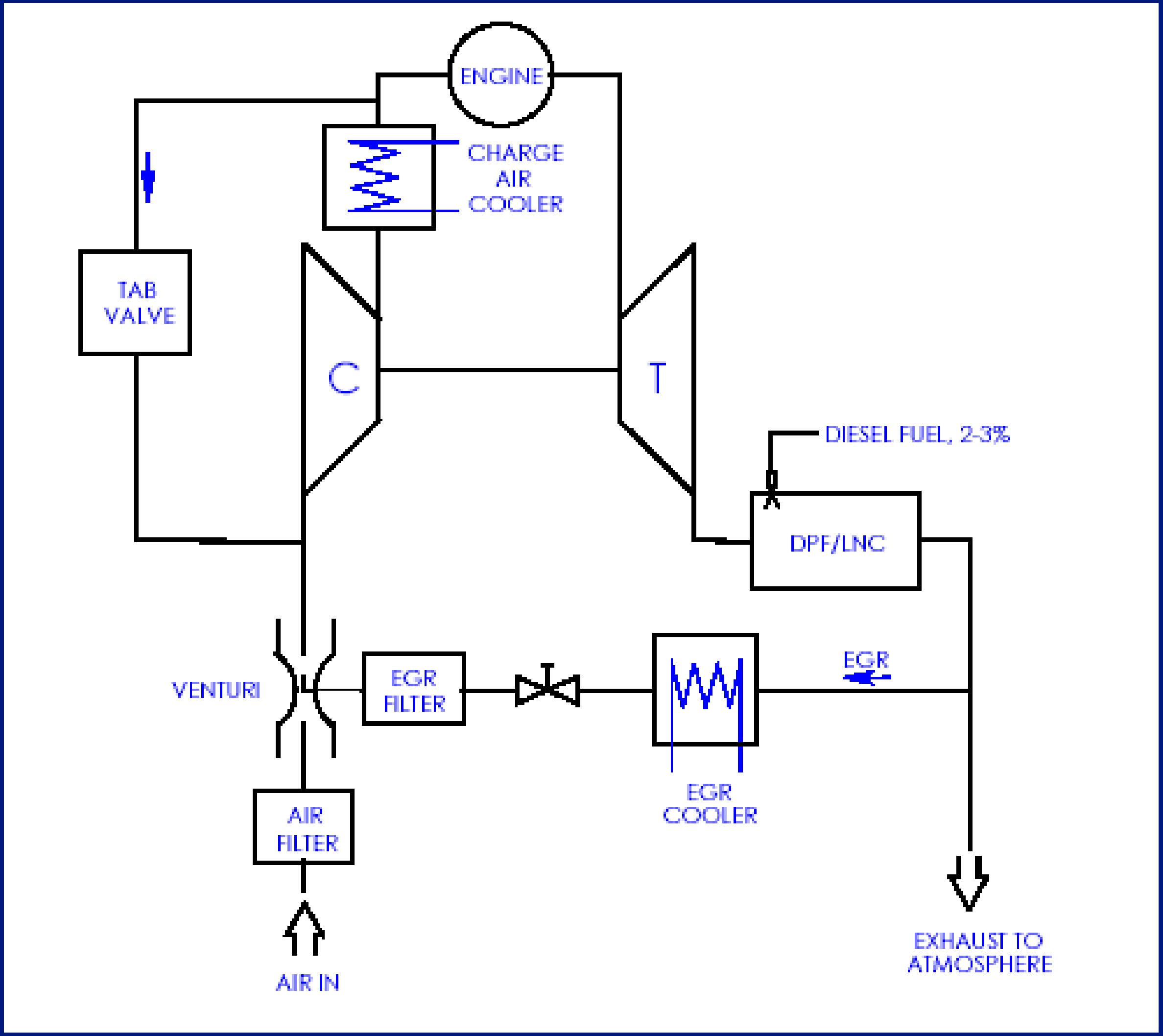
NGNGV Phase I: Clean Air Partners DF C12 w/EGR

Emission Reduction Module #2- Active AT

- Catalyzed DPF
- Cooled EGR
- Lean NOx Adsorber



The recirculated exhaust gases absorb a portion of the energy released during combustion

of the fuel. This decreases the peak combustion temperature, which is the most critical

parameter favoring high NOx formation. This occurs primarily because the carbon

dioxide (CO_2) content is significantly increased, and CO_2 has a much higher specific heat

capacity than nitrogen (N_2). Another reason for lower peak combustion temperature is

that recirculated exhaust gases do not participate in combustion as would fresh air.

Furthermore, the EGR fraction displaces fresh oxygen, making less available for

combustion and thus reducing the probability of interaction between nitrogen and oxygen

atoms even under lean conditions.